

### ABSTRACT

Methods, apparatus and precursors for producing substantially water-free silica soot, preforms and glass. The methods and apparatus make substantially water-free fused silica preforms or glass by removing water as a reaction product, removing water from the atmosphere, removing water from the transport process, or combinations thereof. In a first embodiment, substantially water-free soot, preforms or glass are achieved by using a hydrogen-free fuel, such as carbon monoxide, in the deposition process. In another embodiment, a soot producing burner has parameters that enable operation on a substantially hydrogen-free fuel. End burners, which minimize water production, are also described. Such water-free methods are useful in depositing fluorine-doped soot because of the low water present and the efficiency in which fluorine is incorporated. In another embodiment, glassy barrier layer methods and apparatus are described for minimizing dopant migration, especially fluorine. Laser and induction methods and apparatus for forming the barrier layer are depicted. A chlorine, fluorine and silica precursor, such as chlorofluorosilane, may be utilized to form fluorinated soot. Other methods and apparatus are directed to combinations of conventional and substantially water-free processes. One embodiment is directed to combustion enhancing additives for addition to the substantially hydrogen-free fuels. The methods and apparatus in accordance with the invention are particularly useful for producing photomask substrates and optical fiber preforms.